CHAPTER 2

DESCRIPTION OF THE LOWER CLINCH RIVER WATERSHED

2.1. BACKGROUND. The Clinch River and Watershed are named for one of the first explorers from the Transylvania Land Company to see the river. Dr. Thomas Walker, an explorer and Long Hunter, explored much of the Clinch River Valley in the 1760's. The Upper Clinch River originates in the mountains of Southwestern Virginia; the Lower Clinch River is much calmer, as it originates in the tailwaters of Norris Lake. Oak Ridge National Laboratory is a major facility in the watershed.

This Chapter describes the location and characteristics of the Lower Clinch River Watershed.

2.2. DESCRIPTION OF THE WATERSHED.

2.2.A. General Location. The Lower Clinch River Watershed is located in East Tennessee and includes parts of Anderson, Campbell, Grainger, Knox, Loudon, Morgan, Roane, and Union Counties.

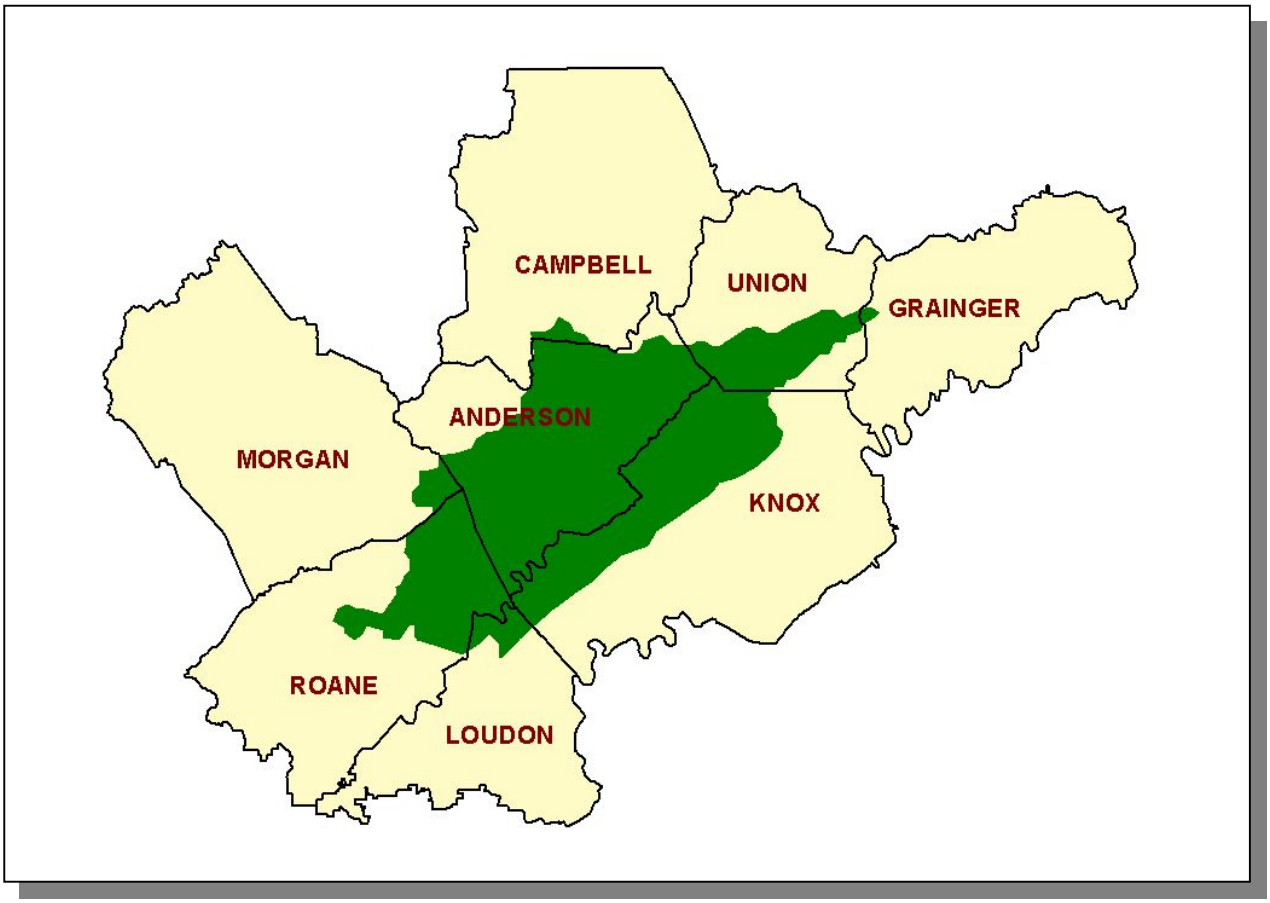

Figure 2-1. General Location of the Lower Clinch River Watershed.

COUNTY	% OF WATERSHED IN EACH COUNTY
Anderson	42.3
Knox	23.8
Roane	18.7
Union	9.1
Loudon	2.7
Morgan	1.8
Campbell	1.3
Grainger	0.2

Table 2-1. The Lower Clinch River Watershed Includes Parts of Eight East Tennessee Counties.

2.2.B. Population Density Centers. Five state highways and two interstates serve the major communities in the Lower Clinch River Watershed.

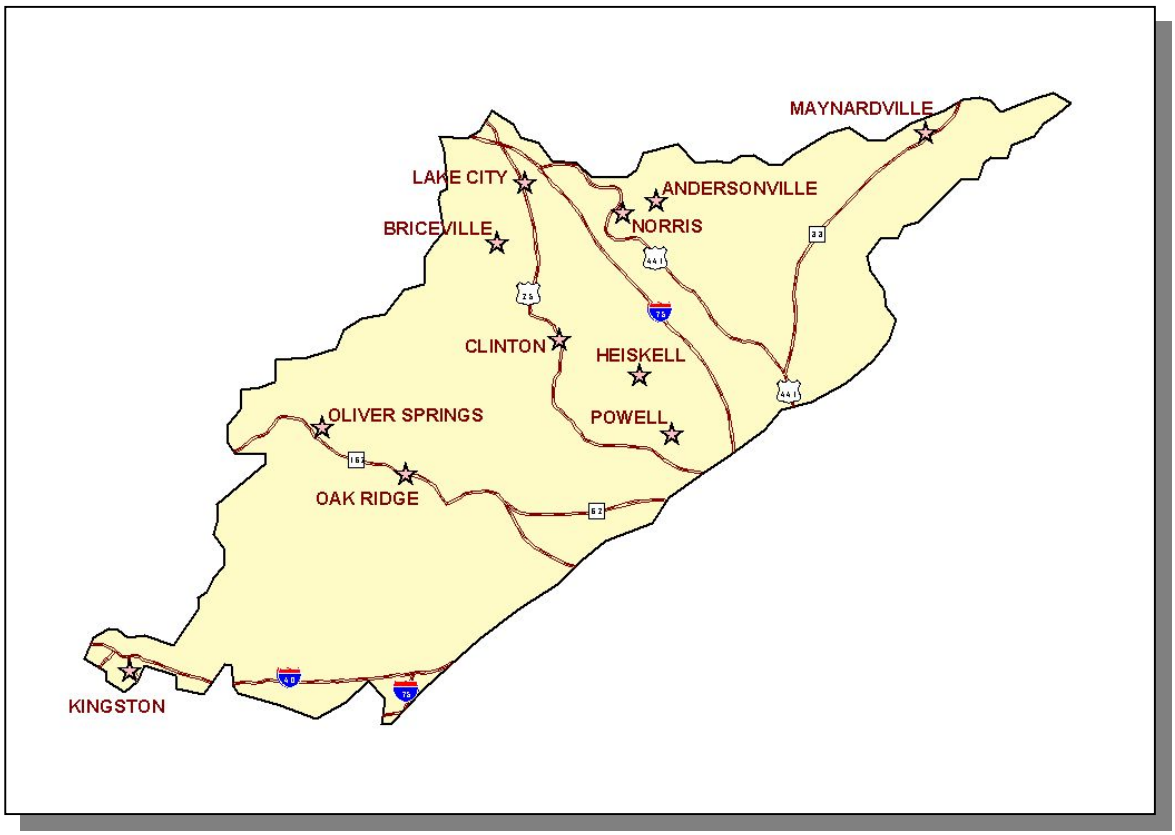

Figure 2-2. Municipalities and Roads in the Lower Clinch River Watershed.

MUNICIPALITY	POPULATION	COUNTY
Oak Ridge	26,788	Anderson
Clinton*	9,755	Anderson
Kingston*	5,398	Roane
Oliver Springs	3,450	Anderson/Roane/Morgan
Lake City	2,086	Anderson
Maynardville*	1,507	Union
Norris	1,231	Anderson

Table 2-2. Communities and Populations in the Lower Clinch River Watershed. *Population based on 1999 census (Tennessee 2001/2002 Blue Book). Asterisk (*) indicates county seat.*

2.3. GENERAL HYDROLOGIC DESCRIPTION.

2.3.A. Hydrology. The Lower Clinch River Watershed, designated 06010207 by the USGS, drains approximately 631 square miles and empties to the Watts Bar Lake Watershed (06010201).

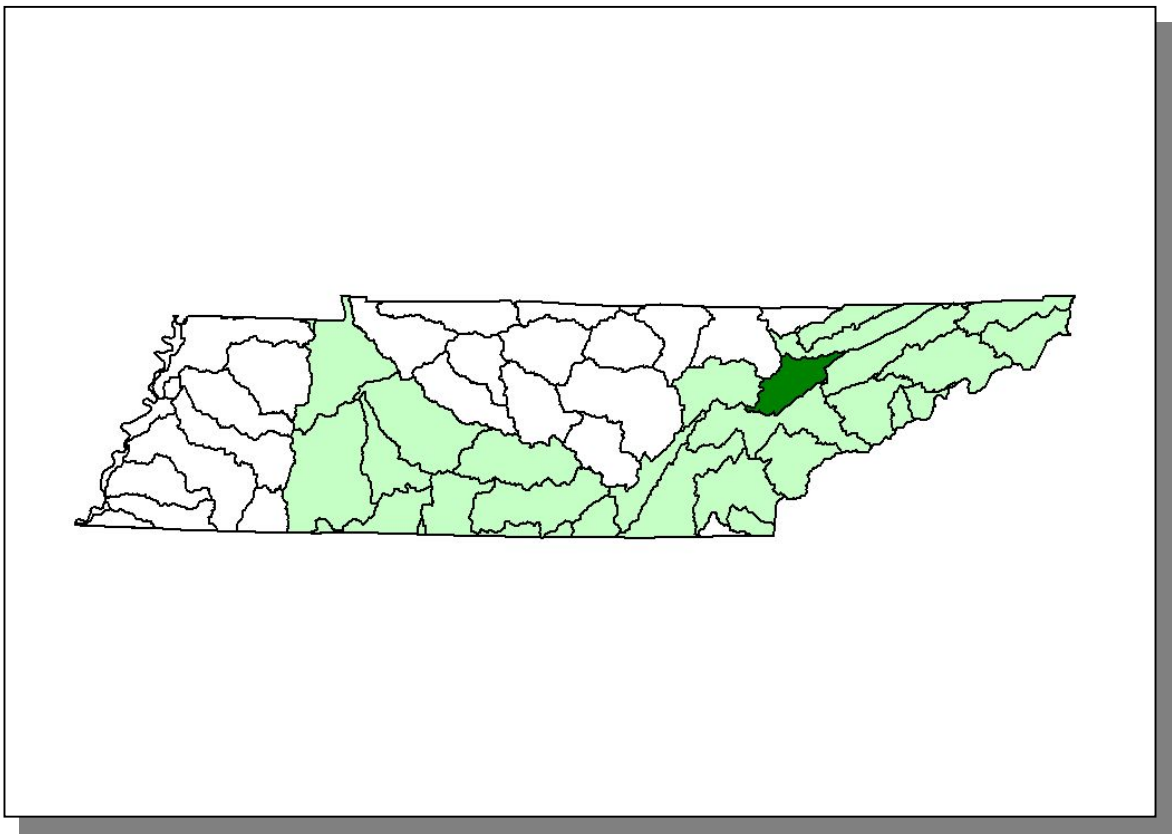

Figure 2-3. The Lower Clinch River Watershed is Part of the Tennessee River Basin.

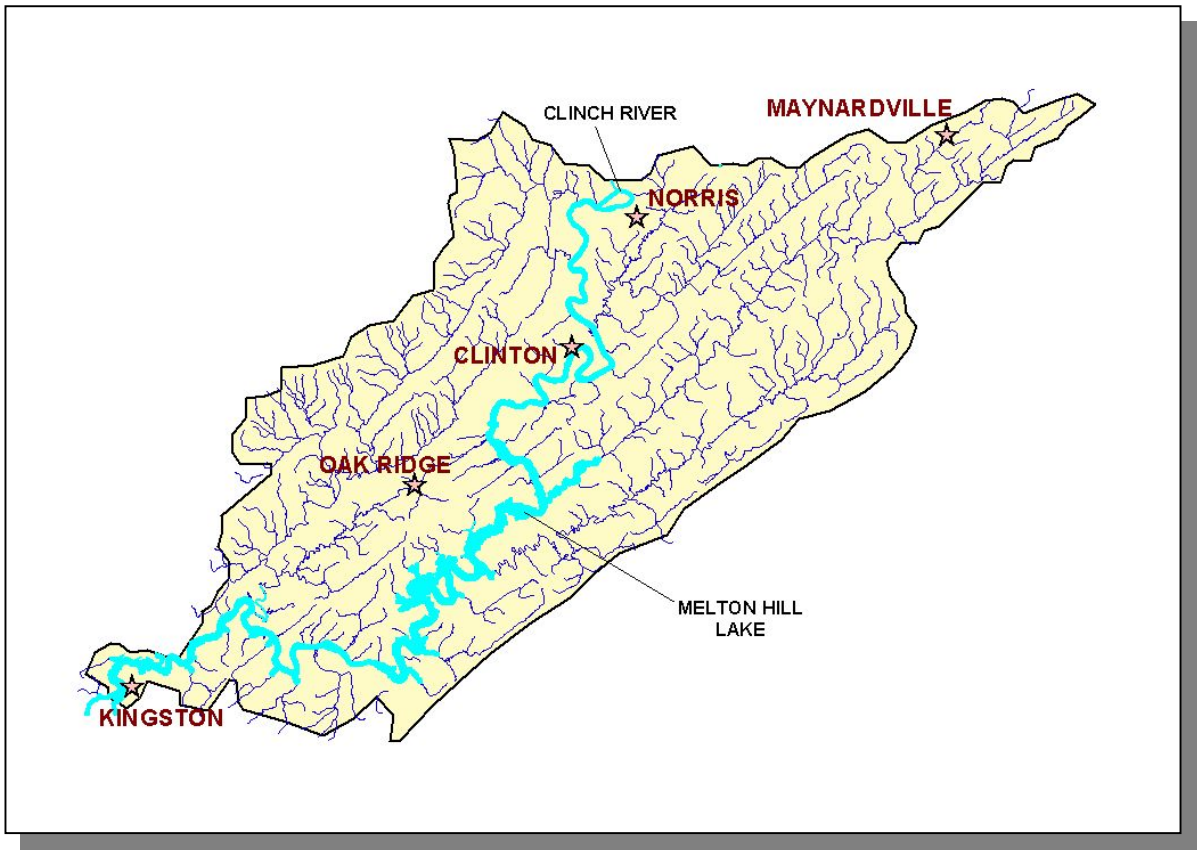

Figure 2-4. Hydrology in the Lower Clinch River Watershed. *There are 802 stream miles and 6,690 lake acres in the Lower Clinch River Watershed as catalogued in the assessment database. Location of the Clinch River and Melton Hill Lake, and the cities of Clinton, Kingston, Maynardsville, Norris, and Oak Ridge are shown for reference.*

2.3.B. Dams. There are 3 dams inventoried by TDEC Division of Water Supply in the Lower Clinch River Watershed. These dams either retain 30 acre-feet of water or have structures at least 20 feet high.

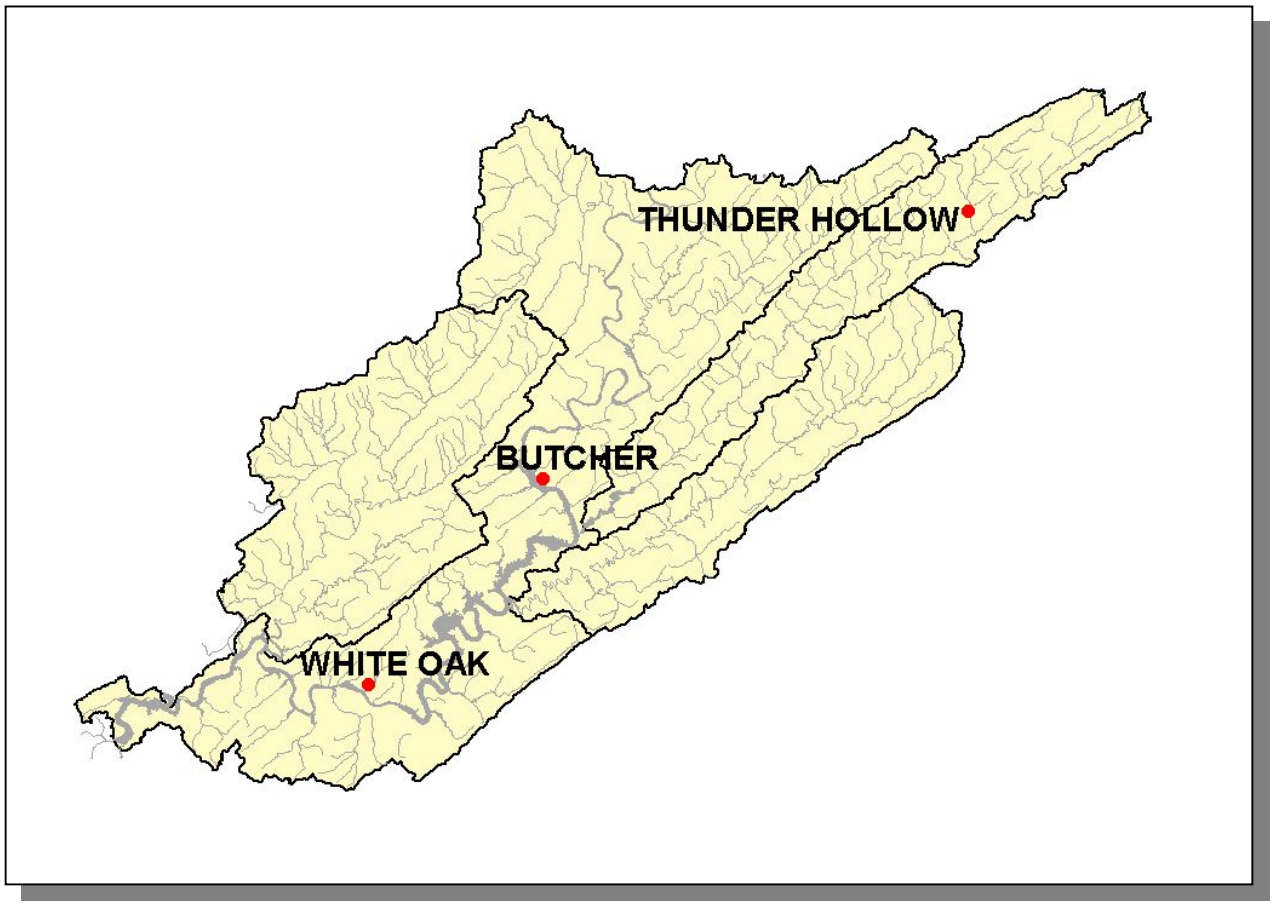

Figure 2-5. Location of Inventoried Dams in the Lower Clinch River Watershed. *More information is provided in Appendix II and on the TDEC homepage at http://gwidc.memphis.edu/website/dws/.*

2.4. LAND USE. Land Use/Land Cover information was provided by EPA Region 4 and was interpreted from 1992 Multi-Resolution Land Cover (MRLC) satellite imagery.

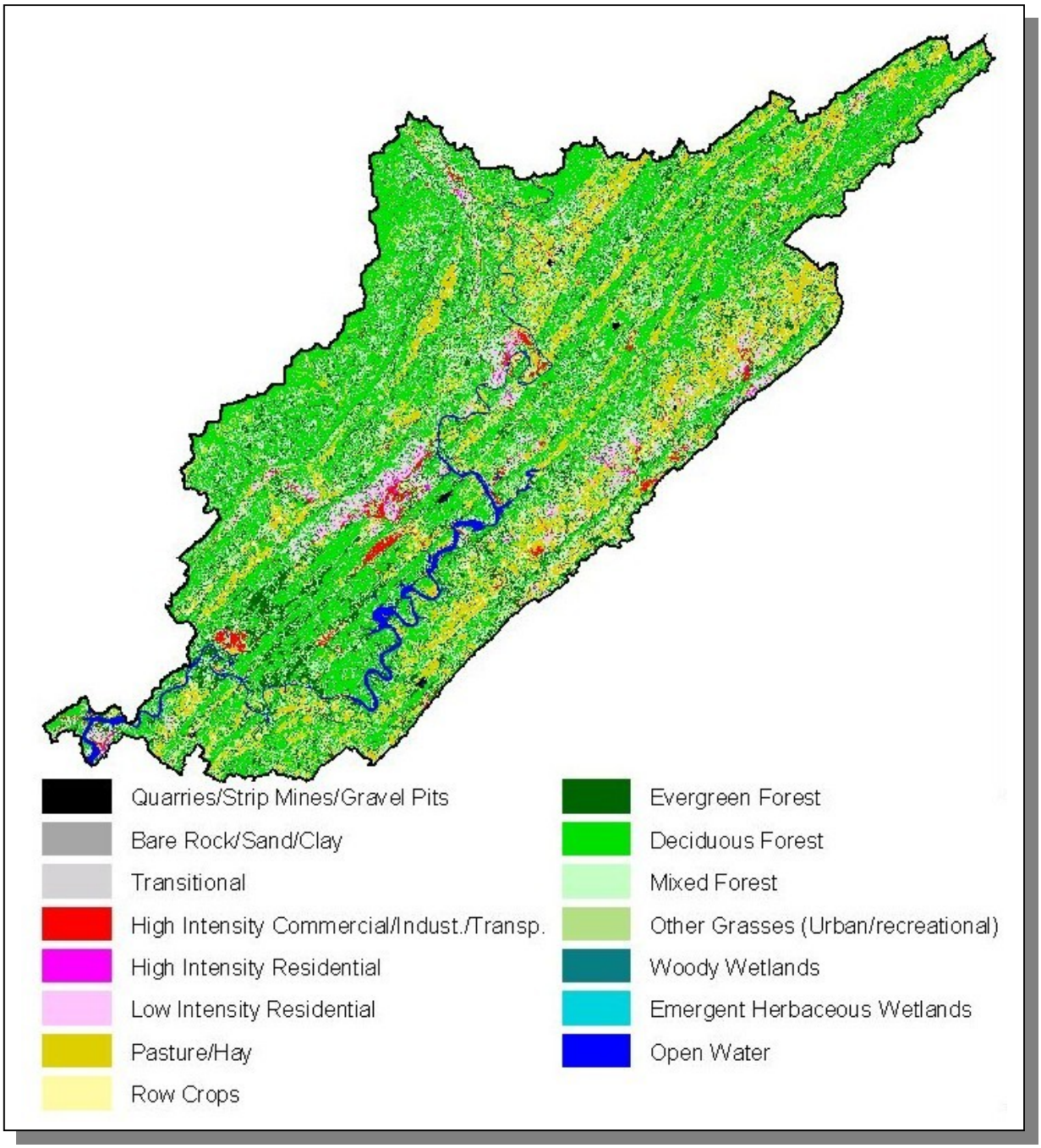

Figure 2-6. Illustration of Select Land Cover/Land Use Data from MRLC Satellite Imagery in the Lower Clinch River Watershed.

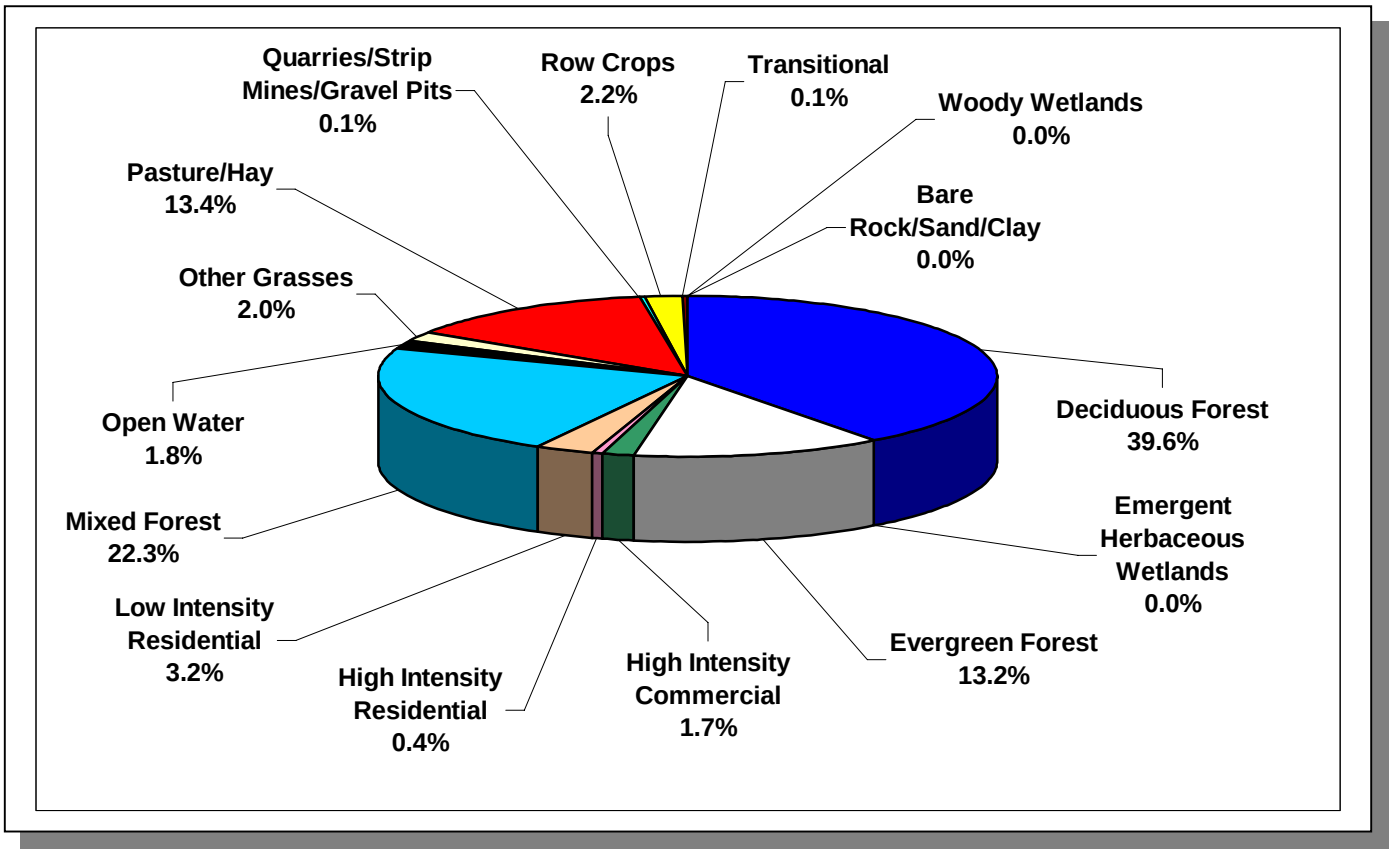

Figure 2-7. Land Use Distribution in the Lower Clinch River Watershed. *More information is provided in Appendix II.*

Sinkholes, springs, disappearing streams and caves characterize karst topography. The term "karst" describes a distinctive landform that indicates dissolution of underlying soluble rocks by surface water or ground water. Although commonly associated with limestone and dolomite (carbonate rocks), other highly soluble rocks such as gypsum and rock salt can be sculpted into karst terrain. In karst areas, the ground water flows through solution-enlarged channels, bedding planes and microfractures within the rock. The characteristic landforms of karst regions are: closed depressions of various size and arrangement; disrupted surface drainage; and caves and underground drainage systems. The term "karst" is named after a famous region in the former country of Yugoslavia.

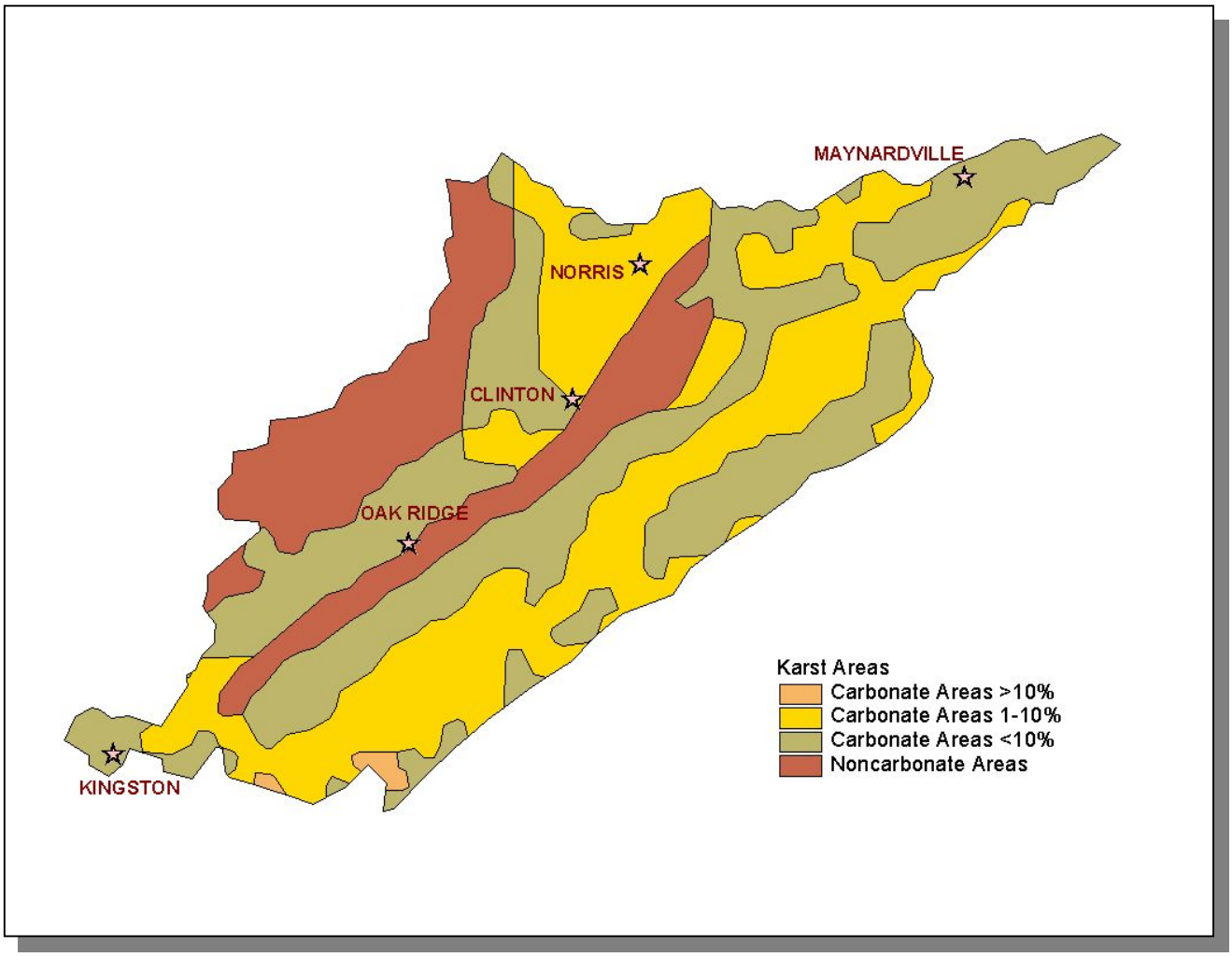

Figure 2-8. Illustration of Karst Areas in Lower Clinch River Watershed. *Locations of Clinton, Kingston, Maynardsville, Norris, and Oak Ridge are shown for reference.*

2.5. ECOREGIONS AND REFERENCE STREAMS. Ecoregions are relatively homogeneous areas of similar geography, topography, climate and soils that support similar plant and animal life. Ecoregions serve as a spatial framework for the assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregion studies can aid the selection of regional stream reference sites, identifying high quality waters, and developing ecoregion-specific chemical and biological water quality criteria.

There are eight Level III Ecoregions and twenty-five Level IV subecoregions in Tennessee. The Lower Clinch River Watershed lies within 3 Level III ecoregions Ridge and Valley, Southwestern Appalachians, and Central Appalachians) and contains 5 Level IV subecoregions:

- **Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f)** form a heterogeneous region composed predominantly of limestone and cherty dolomite. Landforms are mostly low rolling ridges and valleys, and the soils vary in their productivity. Landcover includes intensive agriculture, urban and industrial uses, as well as areas of thick forest. White oak forest, bottomland oak forest, and sycamore-ash-elm riparian forests are the common forest types. Grassland barrens intermixed with cedar-pine glades also occur here.

- **Southern Dissected Ridges and Knobs (67i)** contain crenulated, broken, or hummocky ridges. The ridges on the east side of Tennessee's Ridge and Valley tend to be associated with the Ordovician Sevier shale, Athens shale, and Holston and Lenoir limestones. These can include calcareous shale, limestone, siltstone, sandstone, and conglomerate. In the central and western part the shale ridges are associated with the Cambrian-age Rome Formation: shale and siltstone with beds of sandstone. Chestnut oak forests and pine forests are typical for the higher elevations of the ridges, with white oak, mixed mesophytic forest, and tulip poplar on the lower slopes, knobs, and draws.

- **Cumberland Plateau (68a)** tablelands and open low mountains are about 1000 feet higher than the Eastern Highland Rim (71g) to the west, and receive slightly more precipitation with cooler annual temperatures than the surrounding lower-elevation ecoregions. The plateau surface is less dissected with lower relief compared to the Cumberland Mountains (69d) or the Plateau Escarpment (68c). Elevations are generally 1200-2000 feet, with the Crab Orchard Mountains reaching over 3000 feet. Pennsylvanian-age conglomerate, sandstone, siltstone, and shale is covered by well-drained, acid soils of low fertility. Bituminous coal that has been extensively surface and underground mined underlies the region. Acidification of first and second order streams is common. Stream siltation and mine spoil bedload deposits continue as long-term problems in these headwater systems. Pockets of severe acid mine drainage persist.

- **Plateau Escarpment (68c)** is characterized by steep, forested slopes and high velocity, high gradient streams. Local relief is often 1000 feet or more. The geologic strata include Mississippian-age limestone, sandstone, shale, and

siltstone, and Pennsylvanian-age shale, siltstone, sandstone, and conglomerate. Streams have cut down into the limestone, but the gorge talus slopes are composed of colluvium with huge angular, slabby blocks of sandstone. Vegetation community types in the ravines and gorges include mixed oak and chestnut oak on the upper slopes, mesic forests on the middle and lower slopes (beech-tulip poplar, sugar maple-basswood-ash-buckeye), with hemlock along rocky streamsides and river birch along floodplain terraces.

- **Cumberland Mountains (69d)**, in contrast to the sandstone-dominated Cumberland Plateau (68a) to the west and southwest, are more highly dissected, with narrow-crested steep slopes, and younger Pennsylvanian-age shales, sandstones, siltstones, and coal. Narrow, winding valleys separate the mountain ridges, and relief is often 2000 feet. Cross Mountain, west of Lake City, reaches 3534 feet in elevation. Soils are generally well-drained, loamy, and acidic, with low fertility. The natural vegetation is a mixed mesophytic forest, although composition and abundance vary greatly depending on aspect, slope position, and degree of shading from adjacent landmasses. Large tracts of land are owned by lumber and coal companies, and there are many areas of stripmining. Acid mine drainage is primarily limited to first and second order systems. Siltation as surface run-off remains the primary pollutant from past mining, timber harvest and unpaved roads.

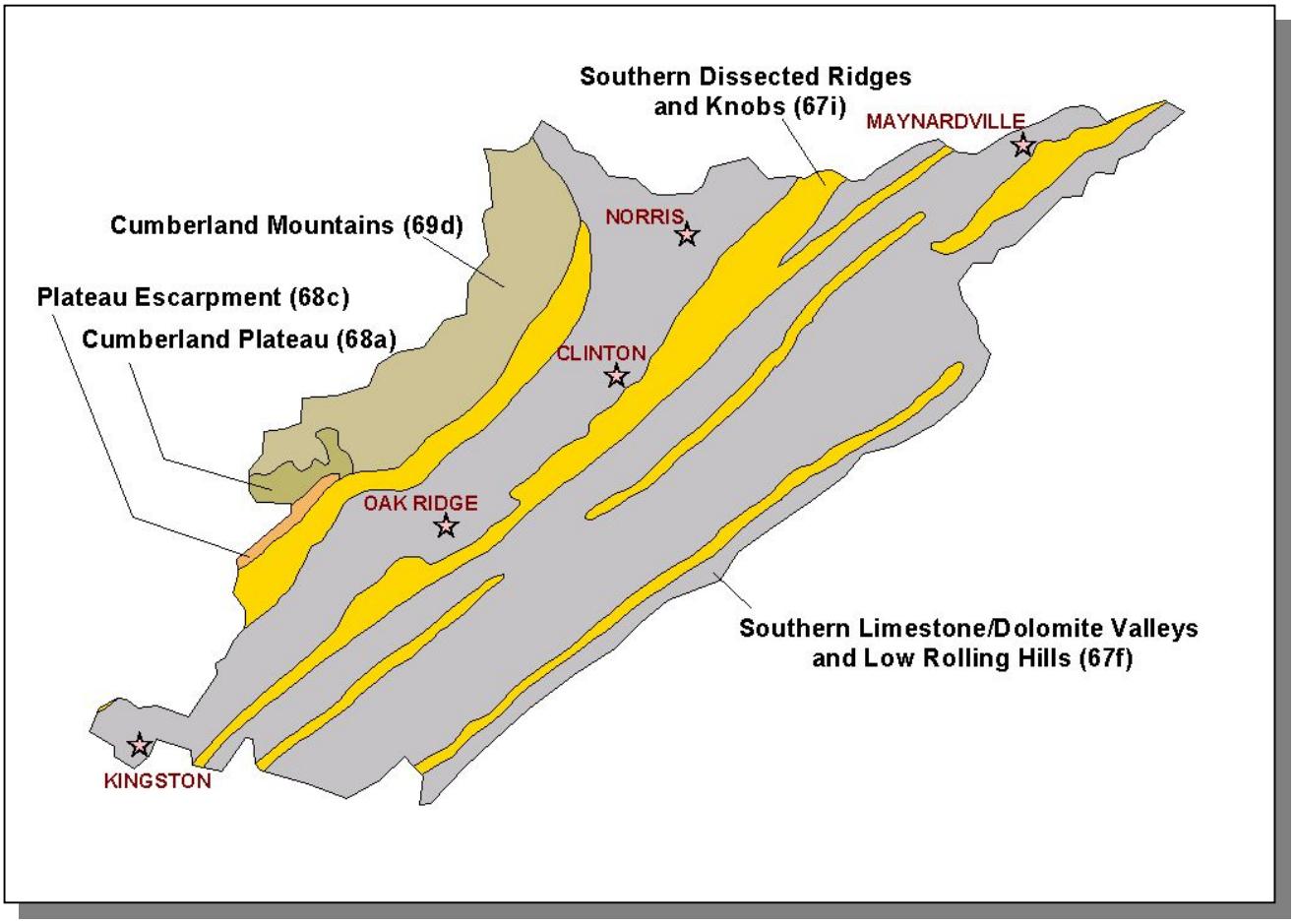

Figure 2-9. Level IV Ecoregions in the Lower Clinch River Watershed. *Locations of Clinton, Kingston, Maynardsville, Norris, and Oak Ridge are shown for reference.*

Each Level IV Ecoregion has at least one reference stream associated with it. A reference stream represents a least impacted condition and may not be representative of a pristine condition.

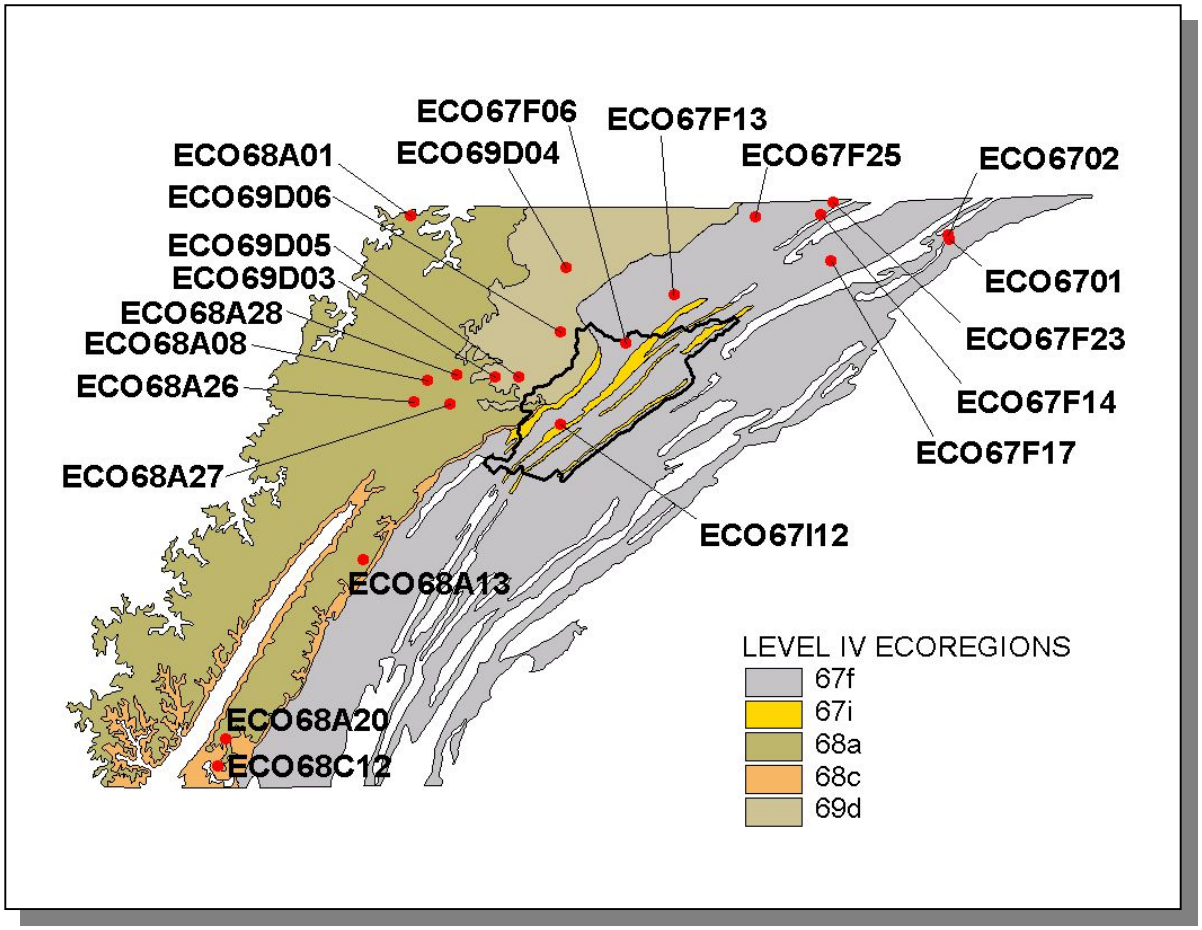

Figure 2-10. Ecoregion Monitoring Sites in Level IV Ecoregions 67f, 67i, 68a, 68c, and 69d in Tennessee. *The Lower Clinch River Watershed boundary is shown for reference. More information is provided in Appendix II.*

2.6. NATURAL RESOURCES.

2.6.A. Rare Plants and Animals. The Heritage Program in the TDEC Division of Natural Heritage maintains a database of rare species that is shared by partners at The Nature Conservancy, Tennessee Wildlife Resources Agency, the US Fish and Wildlife Service, and the Tennessee Valley Authority. The information is used to: 1) track the occurrence of rare species in order to accomplish the goals of site conservation planning and protection of biological diversity, 2) identify the need for, and status of, recovery plans, and 3) conduct environmental reviews in compliance with the federal Endangered Species Act.

GROUPING	NUMBER OF RARE SPECIES
Insects and Spiders	4
Mussels	14
Snails	1
Amphibians	3
Birds	8
Fish	7
Mammals	7
Reptiles	2
Plants	43
Total	**89**

Table 2-3. There are 89 Known Rare Plant and Animal Species in the Lower Clinch River Watershed.

In the Lower Clinch River Watershed, there are 7 rare fish species, 15 rare mussel species, and 1 rare snail species.

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS
Polyodon spathula	Paddlefish		
Hemitremia flammea	Flame Chub	MC	D
Cyprinella monacha	Spotfin Chub	LT	T
Phoxinus tennesseensis	Tennessee Dace		D
Carpiodes velifer	Highfin Carpsucker		D
Cycleptus elongatus	Blue Sucker	MC	T
Noturus flavipinnis	Yellowfin Madtom	LT, XN	E
Cumberlandia monodonta	Spectaclecase		
Cyprogenia irrorata	Eastern Fanshell Pearly Mussel	LE	E
Dromus dromus	Dromedary Pearly Mussel	LE	E
Fusconaia edgariana	Shiny Pigtoe	LE	E
Fusconia cuneolus	Fine-Rayed Pigtoe	LE	E
Hemistena lata	Cracking Pearly Mussel	LE	E
Lampsilis abrupta	Pink Mucket	LE	E
Lampsilis virescens	Alabama Lamp Mussel	LE	E
Conradilla caelata	Birdwing Pearly Mussel	LE	E
Plethobasus cicatricosus	White Whartyback	LE	E
Plethobasus cooperianus	Orange-Foot Pimpleback	LE	E
Pleurobema plenum	Rough Pigtoe	LE	E
Pleurobema plenum	Pyramis Pigtoe		
Quadrula cylindrica strigulata	Rough Rabbitsfoot Pearly Mussel	LE	E
Io fluvalis	Spiny Riversnail		

Table 2-4. Rare Aquatic Species in the Lower Clinch River Watershed. *Federal Status: LE, Listed Endangered by the U.S. Fish and Wildlife Service; LT, Listed Threatened by the U.S. Fish and Wildlife Service; MC, Management Concern for U.S. Fish and Wildlife Service; XN, Non-Essential Experimental Population. State Status: E, Listed Endangered by the Tennessee Wildlife Resources Agency; T, Listed Threatened by the Tennessee Wildlife Resources Agency; D, Deemed in Need of Management by the Tennessee Wildlife Resources Agency. More information may be found at http://www.state.tn.us/environment/nh/data.php.*

2.6.B. Wetlands. The Division of Natural Heritage maintains a database of wetland records in Tennessee. These records are a compilation of field data from wetland sites inventoried by various state and federal agencies. Maintaining this database is part of Tennessee's Wetland Strategy, which is described at:

http://www.state.tn.us/environment/nh/wetlands/

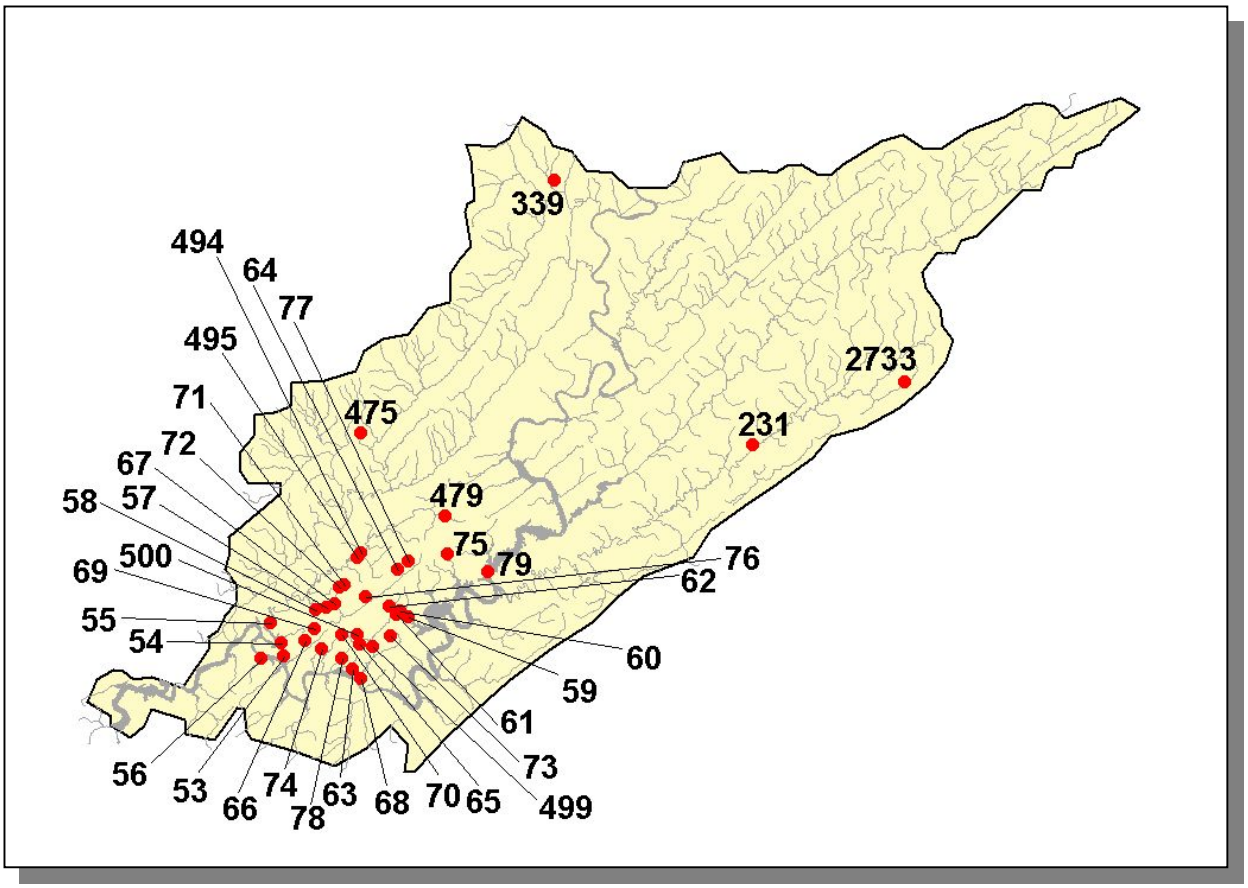

Figure 2-11. Location of Wetland Sites in TDEC Division of Natural Heritage Database in the Lower Clinch River Watershed. This map represents an incomplete inventory and should not be considered a dependable indicator of the presence of wetlands*. More information is provided in Appendix II.*

2.7. CULTURAL RESOURCES.

2.7.A. State Scenic River. A portion of the Lower Clinch River has been designated as a State Scenic River. The portion from Melton Hill Dam upstream to Pellissippi Parkway has been designated as a Class III Scenic River. The Tennessee Scenic Rivers Act of 1968, as amended, defines Class III (Partially Developed Areas) as streams affected by the works of man but which still possess actual or potential scenic values. More information about Tennessee's State Scenic River Program may be found at:

http://www.state.tn.us/environment/nh/scenicrivers/

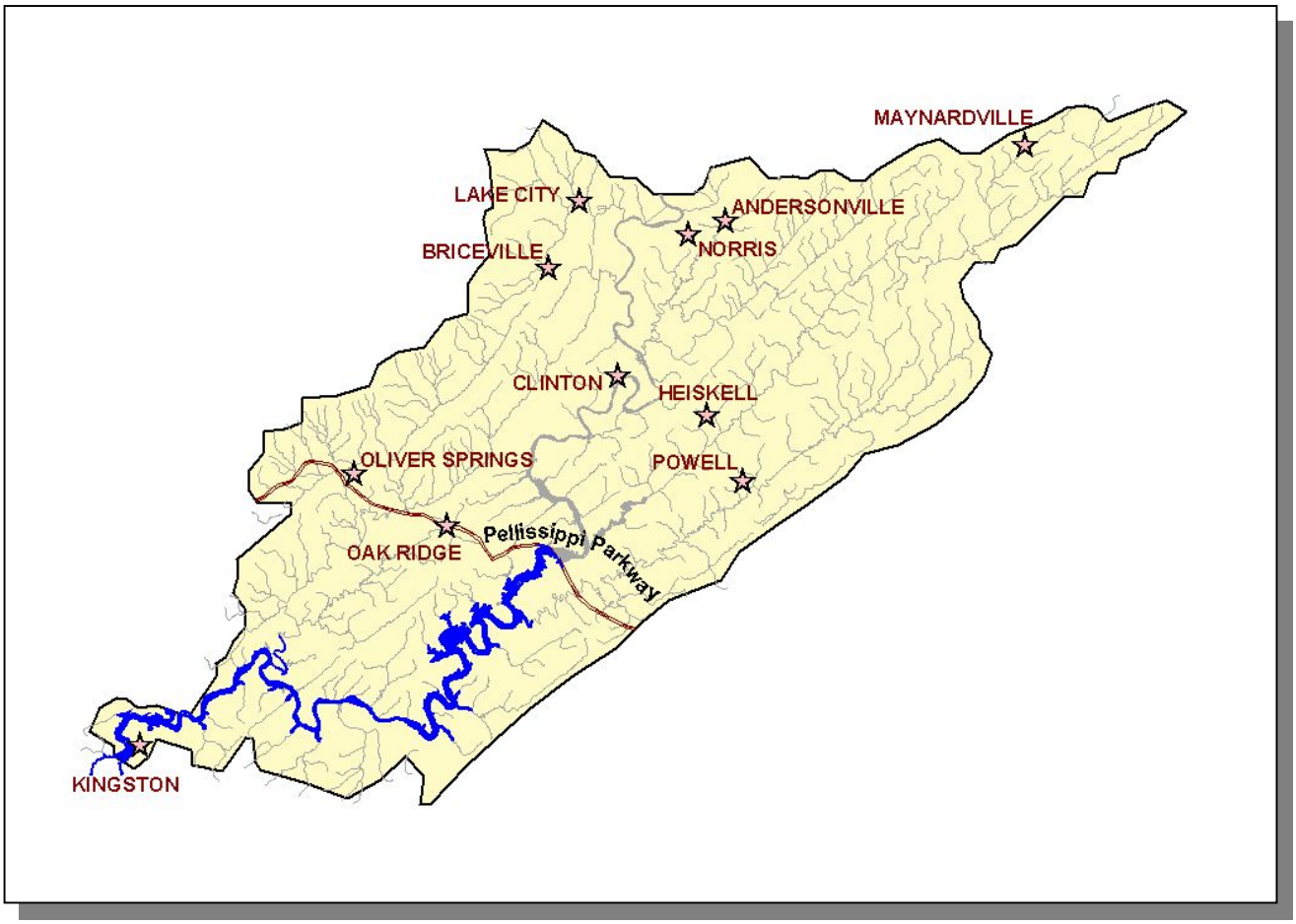

Figure 2-12. A Portion of the Lower Clinch River is Designated as a State Scenic River. *Locations of Andersonville, Briceville, Clinton, Heiskell, Kingston, Lake City, Maynardsville, Norris, Oliver Springs, Oak Ridge, and Powell are shown for reference.*

2.7.B. Nationwide Rivers Inventory. The Nationwide Rivers Inventory, required under the Federal Wild and Scenic Rivers Act of 1968, is a listing of free-flowing rivers that are believed to possess one or more outstanding natural or cultural values. Exceptional scenery, fishing or boating, unusual geologic formations, rare plant and animal life, cultural or historic artifacts that are judged to be of more than local or regional significance are the values that qualify a river segment for listing. The Tennessee Department of Environment and Conservation and the Rivers and Trails Conservation Assistance branch of the National Park Service jointly compile the Nationwide Rivers Inventory from time to time (most recently in 1997). Under a 1980 directive from the President's Council on Environmental Quality, all Federal agencies must seek to avoid or mitigate actions that would have an adverse effect on Nationwide Rivers Inventory segments.

The most recent version of the Nationwide Rivers Inventory lists portions of one stream in the Lower Clinch River Watershed:

> Clinch River, a river with numerous recorded archaeological sites, steep ridges, long, shallow shoal areas and deep pools. The upper reach provides for an excellent pastoral float and provides habitat for the most diverse mussel fauna in the world.

RIVER	SCENIC	RECREATION	GEOLOGIC	FISH	WILDLIFE	HISTORIC	CULTURAL
Clinch River	X	X	X	X	X	X	X

Table 2-5. Attributes of Streams Listed in the Nationwide Rivers Inventory.

Additional information may be found online at:

http://www.nps.gov/ncrc/programs/rtca/nri/index.html

2.7.C. Greenways. The Lower Clinch River Watershed has at least fourteen greenways/trails:

- Big Turtle Trail in Oak Ridge
- Cedar Hill Trail in Oak Ridge
- Emory Valley Trail in Oak Ridge
- Gallaher Bend Greenway in Oak Ridge
- Haw Ridge Trail in Oak Ridge
- Justin P. Wilson Cumberland Trail
- Melton lake Drive Greenway in Oak Ridge
- North Boundary Greenway in Oak Ridge
- North Ridge Trail in Oak Ridge
- Old Bethel Valley Road Greenway in Oak Ridge
- Pine Grove Trail in Oak Ridge
- Wildflower Trail in Oak Ridge
- Worthington Greenway in Oak Ridge

More information about greenways and trails in the watershed may be found at:
http://www2.state.tn.us/tdec/GREENWAYS/tnmap.htm

2.7.D. Interpretive Areas. Some sites representative of the natural or cultural heritage are under state or federal protection:

- Big Ridge State Park was one of five demonstration parks developed by the TVA in cooperation with the National Park Service and the Civilian Conservation Corps. The 3,687-acre park is located on Norris Lake. The park is managed by the state of Tennessee.
- Eagle Bend Hatchery is a TWRA warm water hatchery located in Clinton. The site is managed by Tennessee Wildlife Resources Agency.
- Melton Hill Reservation includes the dam, a boathouse, swimming area, camping area, and boat launch ramps on Melton Hill Lake. The site is managed by TVA.
- Norris Dam State Park is located on Norris Lake by Norris Dam. The park is more than 4,000 acres and, in addition to the lake, contains caves, scenic valleys, and a virgin forest. The site is managed by the state of Tennessee.

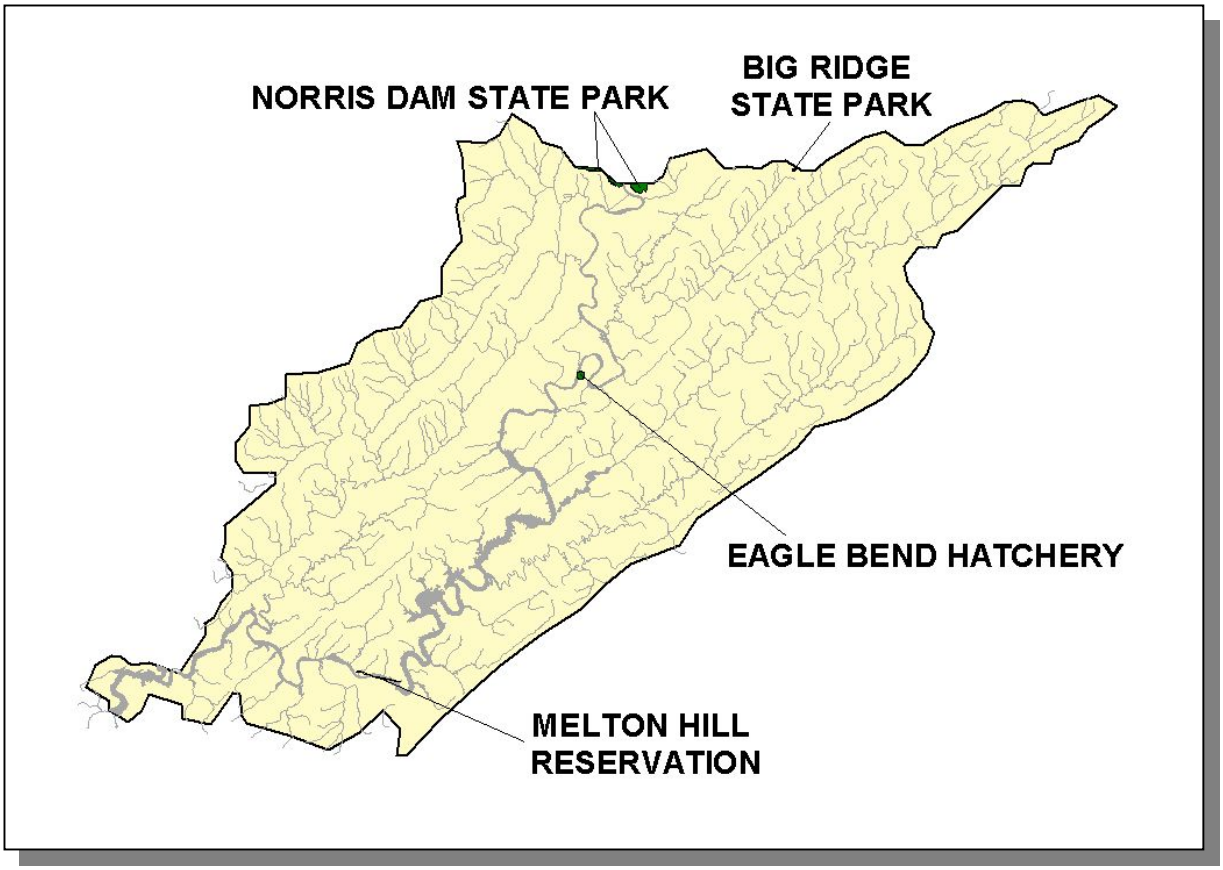

Figure 2-13. Locations of State- and Federally-Managed Lands in the Lower Clinch River Watershed.

2.7.E. Wildlife Management Area. The Tennessee Wildlife Resources Agency manages four wildlife management areas in the Lower Clinch River Watershed.

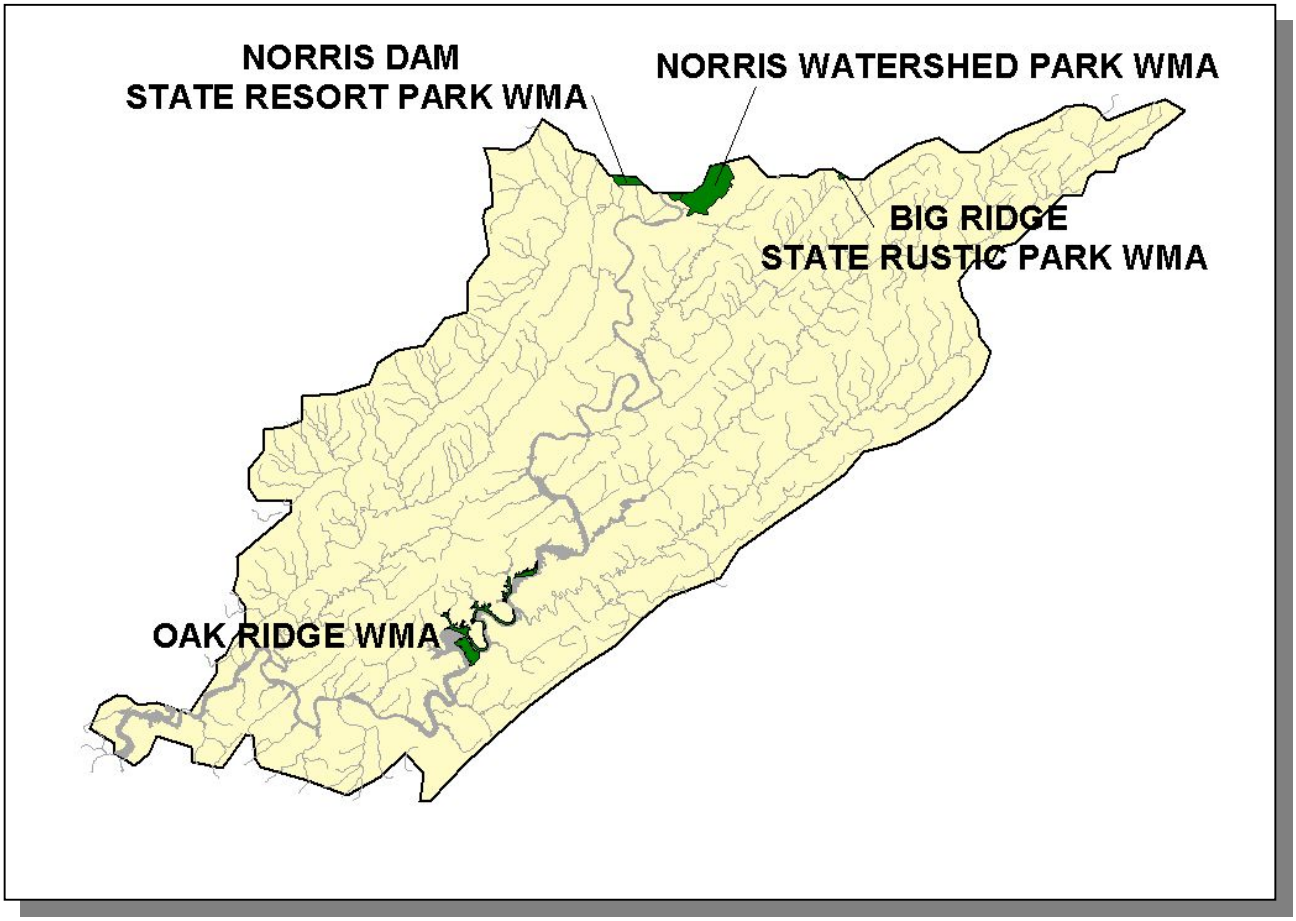

Figure 2-14. TWRA Manages Wildlife Management Areas in the Lower Clinch River Watershed.

2.8. Tennessee Rivers Assessment Project. The Tennessee Rivers Assessment is part of a national program operating under the guidance of the National Park Service's Rivers and Trails Conservation Assistance Program. The Assessment is an inventory of river resources, and should not be confused with "Assessment" as defined by the Environmental Protection Agency. A more complete description can be found in the Tennessee Rivers Assessment Summary Report, which is available from the Department of Environment and Conservation and on the web at:

http://www.state.tn.us/environment/wpc/publications/riv/

STREAM	NSQ	RB	RF		STREAM	NSQ	RB	RF
Bear Creek	3				East Fork Poplar Creek	4		
Beaver Creek	3	3			Grassy Creek	3		
Buffalo Creek	3		1		Hinds Creek	3		2,4
Bull Run Creek	2		3		North Fork Bull Run Creek	3		4
Clinch River	2,3	2			Poplar Creek	2		
Coal Creek	3		1		Whiteoak Creek	4		

Table 2-6. Stream Scoring from the Tennessee Rivers Assessment Project in the Lower Clinch River Watershed.

Categories: NSQ, Natural and Scenic Qualities
RB, Recreational Boating
RF, Recreational Fishing

Scores: 1. Statewide or greater Significance; Excellent Fishery
2. Regional Significance; Good Fishery
3. Local Significance; Fair Fishery
4. Not a significant Resource; Not Assessed